GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Mechanical Engineering

(NBA Tier-I Accredited)

CURRICULUM 2025

B.E. – MECHANICAL ENGINEERING

Academic Year: [2025-2026] | Regulation: [R2025]

Program Overview

Program Duration: 4 Years (8 Semesters)

Total Credits Required: 168 Credits

Affiliated University: Anna University, Chennai

NBA Accreditation Status: [Tier I – Accredited, AY 2024-25 to 2026-27, Upto 30.06.2027]

Program Outcomes:

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyse complex problems using research and sustainability principles.
3. **Design Solutions:** Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations:** Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools:** Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment:** Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics:** Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork:** Work effectively as an individual and in multidisciplinary teams.
9. **Communication:** Communicate clearly in reports, presentations, and documentation across diverse groups.
10. **Management & Finance:** Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning:** Engage in continuous learning, adapt to new technologies, and think critically.

Program Specific Outcome

PSO1: Apply core mechanical engineering principles along with advanced CAD/CAE tools to design, model, and simulate mechanical systems. Develop creative, safe, and sustainable solutions while adhering to ethical standards, communicating effectively, and embracing continuous learning in response to technological advancements.

PSO2: Integrate traditional and advanced manufacturing methods, robotics, and Industry 4.0 technologies—including AI, IoT, and data analytics—to solve complex engineering problems. Demonstrate teamwork, leadership, and project management skills, while being responsive to industrial practices, global trends, and lifelong learning needs.

PSO3: Design and optimize thermal and fluid systems with an emphasis on energy efficiency, environmental responsibility, and societal impact. Utilize research-based methods, engineering tools, and sustainability principles to address global energy challenges, ensuring preparedness for life-long learning and professional growth.

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Vision of the Department

"To be a leading center for mechanical engineering education and research, fostering innovation, entrepreneurship, and societal impact."

Mission of the Department

M1: Impart high-quality education and hands-on training in mechanical engineering, enabling students to become competent, innovative, and industry-ready professionals.

M2: Foster a culture of research and development by providing state-of-the-art facilities and promoting interdisciplinary and industry-oriented innovation.

M3: Instill ethical responsibility and a commitment to lifelong learning while addressing societal and environmental challenges through engineering excellence and community engagement.

Program Educational Objectives (PEOs):

PEO1 – Technical Competence:

Graduates will establish themselves as successful professionals in mechanical engineering and related fields by applying strong technical knowledge, problem-solving abilities, and modern engineering tools.

PEO2 – Professional Development and Leadership:

Graduates will demonstrate effective communication, teamwork, and leadership skills, pursue lifelong learning, and adapt to evolving technologies and multidisciplinary work environments.

PEO3 – Ethical and Societal Responsibility:

Graduates will uphold high ethical standards, practice responsible engineering, and contribute meaningfully to society and sustainable development through innovative and inclusive solutions.

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Credit Distribution Comparison

Component	Anna University	AICTE Norms	GCE Bargur
Humanities & Social Sciences (HS)	13	12	**11**
Mathematics & Basic Sciences (BS)	25	25	**29**
Engineering Sciences (ES)	24	24	**23**
Professional Core (PC)	56	48	**66**
Professional Electives (PE)	21	18	**18**
Open Electives (OE)	12	18	**9**
Project Work (PR) **Employability Enhancement (EE)**	16	15	**14**
Mandatory courses (MC)	-	-	**-**
Total Credits	167	160	**170**

Category Abbreviations

BS - Basic Sciences | **ES** - Engineering Sciences | **PC** - Professional Core

PE - Professional Electives | **OE** - Open Electives | **HS** - Humanities & Social Sciences

| **MC** Mandatory courses | **PR** – Project | **EE** Employability Enhancement

Notes

- Legend: L - Lecture Hours per Week | T - Tutorial Hours per Week | P - Practical Hours per Week | C - Credits
- Credits are calculated as: L + T + P/2 for theory courses with lab, and based on contact hours for other courses.
- Professional Electives are domain-specific advanced subjects.
- Open Electives can be chosen from any other department to promote interdisciplinary learning.

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Key difference in R2025 over Regulation 2022

1. Vision, Mission, PEOs, and PSOs have been updated based on current trends and emerging technologies.

2. All courses are revised to include activity-based learning, addressing PO4 to PO11 through Continuous Internal Evaluation (CIE).

3. Emerging technology–focused courses have been introduced under the Professional Elective (PE) category.

4. Professional Elective groups/verticals have been revised to align with current industry requirements.

5. Separate advanced-level courses have been introduced for the Honors Degree program.

6. Separate basic-level courses have been introduced for the Minor Degree program.

7. New basic-level courses have been introduced under the Open Elective category.

8. Operations Research, Industrial Automation, Embedded Systems, and Robotics have been introduced as compulsory courses in the curriculum.

9. Thermal Engineering courses have been converted into integrated courses with theory and laboratory components.

10. Major revisions have been made in the syllabus of key courses to incorporate current industrial scenarios and technological advancements courses are revised to include activity-based learning, addressing PO4 to PO11 through Continuous Internal Evaluation (CIE).

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SEMESTER-WISE CURRICULUM STRUCTURE

SEMESTER I

S.No	Course Code	Course Title	L	T	P	C	Category
1	25ZHS101	English for Engineers -I	3			3	HS
2	25ZBS102	Matrices and Calculus	3	1		4	BS
3	25ZBS103	Engineering Physics	3		2	4	BS
4	25MES105	Problem Solving and Python Programming	3		2	4	ES
5	25ZES106	Engineering Graphics	1		4	3	ES
6	25ZMC107	Heritage of Tamils / **தமிழர் மரபு**	1			0	MC
7	25ZES110	Engineering Practices Laboratory			4	2	ES
Total			**14**	**1**	**12**	**20**	

SEMESTER II

S.No	Course Code	Course Title	L	T	P	C	Category
1	25ZHS201	English for Engineers – II	3			3	HS
2	25MBS202	Complex Analysis and Differential Equations	3	1		4	BS
3	25MBS203	Material Science	3			3	BS
4	25MBS204	Applied Chemistry	3		2	4	BS
5	25MES205	Engineering Mechanics	3	1		4	ES
6	25MES206	Basic Electrical and Electronics Engineering	3		2	4	ES
7	25ZMC207	Tamils and Technology / **தமிழரும் தொழில்நுட்பமும்**	1			0	MC
8	25ZHS210	Communication English Laboratory			2	1	HS
Total			**19**	**2**	**6**	**23**	

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SEMESTER III

S.No	Course Code	Course Title	L	T	P	C	Category
1	25MBS301	Probability and Statistics	3	1		4	BS
2	25MPC302	Engineering Thermodynamics	3	1		4	PC
3	25MPC303	Strength of Materials & Testing	3		2	4	PC
4	25MPC304	Manufacturing Processes	3			3	PC
5	25MES305	Engineering Codes and Standards	2	0	0	2	PC
6	25ZMC306	Constitution of India	1			0	MC
7	25MES307	Engineering Materials and Metallurgy	3		2	4	ES
8	25MES308	Embedded systems and IOT	2			2	ES
9	25MPC309	Computer Aided Machine Drawing			4	2	PC
Total			**20**	**2**	**8**	**25**	

SEMESTER IV

S.No	Course Code	Course Title	L	T	P	C	Category
1	25MBS401	Transforms and Numerical Techniques	3	1		4	BS
2	25MPC402	Kinematics of Machines	3			3	PC
3	25MPC403	Hydraulics and Pneumatics	3			3	PC
4	25MPC404	Thermal Engineering	3		2	4	PC
5	25MPC405	Fluid Mechanics and Fluid Machinery	3		2	4	PC
6	25ZBS406	Environmental Science and Sustainability	2			2	BS
7	25MPC407	Manufacturing Technology	3		2	4	PC
Total			**20**	**1**	**6**	**24**	

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SEMESTER V

S.No	Course Code	Course Title	L	T	P	C	Category
1	25MPC501	Design of Machine Elements	3	1		4	PC
2	25MPC502	Dynamics of Machinery	3		2	4	PC
3	25MPC503	Heat and Mass Transfer	3		2	4	PC
4	25MPC504	Measurements and Instrumentation	3		2	4	PC
5	25MPC505	Power Generation Technologies	2			2	PC
6		Professional Elective - I	3			3	PE
7		Open Elective - I	3			3	OE
Total			**20**	**1**	**6**	**24**	

SEMESTER VI

S.No	Course Code	Course Title	L	T	P	C	Category
1	25MPC601	Design of Transmission Systems	3			3	PC
2	25MPC602	Applications of Finite Element Analysis	3		2	4	PC
3	25MPC603	Industrial Automation	3		2	4	PC
4	25ZHS604	Project Management	2			2	HS
5		Professional Elective - II	3			3	PE
6		Professional Elective - III	3			3	PE
7		Open Elective - II	3			3	OE
8	25MPR608	Conceptualisation / Prototype preparation			2	2	PR
Total			**20**	**0**	**6**	**24**	

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SEMESTER VII

S.No	Course Code	Course Title	L	T	P	C	Category
1	25ZHS701	Human Values and Professional Ethics	2			2	HS
2	25MPC702	Robotics	3		2	4	PC
3		Professional Elective - IV	3			3	PE
4		Professional Elective - V	3			3	PE
5		Professional Elective - VI	3			3	PE
6		Open Elective - III	3			3	OE
7	25MPR708	Project – I			8	4	PR
Total			**17**	**0**	**10**	**22**	

SEMESTER VIII

S.No	Course Code	Course Title	L	T	P	C	Category
1	25MPR801	Project - II	0	0	16	8	PR
Total			**0**	**0**	**16**	**8**	

TOTAL NO. OF CREDITS: 170

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Professional Electives (PE)

Students must choose 6 Professional Electives

S.No	Course Code	Course Title	L	T	P	C
1.	25MPE001	Refrigeration & HVAC Systems	3	0	0	3
2.	25MPE002	Battery Technology	3	0	0	3
3.	25MPE003	Gas Dynamics and Jet Propulsion	3	0	0	3
4.	25MPE004	Vehicle Technology	3	0	0	3
5.	25MPE005	Computational Fluid Dynamics	3	0	0	3
6.	25MPE006	Renewable Energy Systems	3	0	0	3
7.	25MPE007	Energy Conservation and Management	3	0	0	3
8.	25MPE008	Hybrid and Electric Vehicle Technology	3	0	0	3
9.	25MPE009	Thermal Management of Batteries and Fuel Cells	3	0	0	3
10.	25MPE010	Energy Saving Machinery and Components	3	0	0	3
11.	25MPE011	Digital Manufacturing	3	0	0	3
12.	25MPE012	Industrial Robotics	3	0	0	3
13.	25MPE013	Industrial IoT	3	0	0	3
14.	25MPE014	Welding Engineering	2	0	1	3
15.	25MPE015	Additive Manufacturing	2	0	1	3
16.	25MPE016	Theory of Metal Cutting	3	0	0	3
17.	25MPE017	Process Planning and Cost Estimation	3	0	0	3
18.	25MPE018	Non-traditional Machining Processes	3	0	0	3
19.	25MPE019	Green Manufacturing Design and Practices	3	0	0	3
20.	25MPE020	CAD/CAM and CIM	3	0	0	3
21.	25MPE021	Computer-Aided Design and Prototyping	3	0	0	3
22.	25MPE022	Tool Design	3	0	0	3
23.	25MPE023	Tribological Design	3	0	0	3

S.No	Course Code	Course Title	L	T	P	C
24.	25MPE024	Mechanical Vibrations	3	0	0	3
25.	25MPE025	Design for Manufacturing and Assembly	3	0	0	3
26.	25MPE026	Electric Vehicle Design	3	0	0	3
27.	25MPE027	Digital Twin	3	0	0	3
28.	25MPE028	Integrated Product Design and Development	3	0	0	3
29.	25MPE029	Ergonomics in Design	3	0	0	3
30.	25MPE030	Smart Mobility and Intelligent Vehicles	3	0	0	3
31.	25MPE031	Vehicle Health Monitoring and Safety	3	0	0	3
32.	25MPE032	Robotics and Automation Systems	3	0	0	3
33.	25MPE033	Artificial Intelligence and Machine Learning	3	0	0	3
34.	25MPE034	Composite Materials	3	0	0	3
35.	25MPE035	Fundamentals of Nanomaterials	3	0	0	3
36.	25MPE036	Nano Technology and Surface Engineering	3	0	0	3
37.	25MPE037	Materials for Electronics	3	0	0	3
38.	25MPE038	Materials Characterization	3	0	0	3
39.	25MPE039	Mechanical Behaviour of Materials	3	0	0	3
40.	25MPE040	Surface Engineering	3	0	0	3
41.	25MPE041	Failure Analysis and NDT Techniques	2	0	1	3
42.	25MPE042	Automotive Materials and Testing	3	0	0	3
43.	25MPE043	Optimisation Techniques	3	0	0	3
44.	25MPE044	Lean Manufacturing	3	0	0	3
45.	25MPE045	Supply Chain Analytics	3	0	0	3
46.	25MPE046	Quality Engineering	3	0	0	3
47.	25MPE047	Life Cycle Assessment	3	0	0	3
48.	25MPE048	Total Quality Management	3	0	0	3

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S.No	Course Code	Course Title	L	T	P	C
49.	25MPE049	Industrial Safety	3	0	0	3
50.	25MPE050	Environment Sustainability and Impact Assessment	3	0	0	3
51.	25MPE051	Value Engineering	3	0	0	3
52.	25MPE052	Entrepreneurship Development	3	0	0	3
53.	25MPE053	Operations Research	3	0	0	3

Open Electives (OE)

Open Electives offered to other departments (3 credits each = 12 credits)

S.No	Course Code	Course Title	L	T	P	C
1	25M0E001	Engineering Economics	3	0	0	3
2	25M0E002	Industrial Engineering	3	0	0	3
3	25M0E003	Entrepreneurial Management	3	0	0	3
4	25M0E004	Elements of Project Management	3	0	0	3
5	25M0E005	Non Destructive Testing	3	0	0	3
6	25M0E006	Composite Materials	3	0	0	3
7	25M0E007	Renewable Energy Sources	3	0	0	3
8	25M0E008	Industrial Safety Engineering	3	0	0	3
9	25M0E009	Rapid Prototyping and Tooling	3	0	0	3
10	25M0E010	Welding Technology	3	0	0	3
11	25M0E011	Heating, Ventilation and Air Conditioning	3	0	0	3
12	25M0E012	Reverse Engineering	3	0	0	3
13	25M0E013	Quality Engineering	3	0	0	3
14	25M0E014	Energy Engineering	3	0	0	3
15	25M0E015	Power Plant Engineering	3	0	0	3

Electives for Honours Degree (Advanced Level Courses)

S.No	Course Code	Course Title	L	T	P	C
1	25MHNR01	Advanced Heat Transfer	3	1	0	4
2	25MHNR02	Advanced Fluid Mechanics	3	1	0	4
3	25MHNR03	Advanced Engineering Materials	3	1	0	4
4	25MHNR04	Design of Heat Exchangers	3	1	0	4
5	25MHNR05	Design and Optimization of Thermal Energy Systems	3	1	0	4
6	25MHNR06	Fuels Combustion and Emission Control	3	1	0	4
7	25MHNR07	Advanced Computational Methods in Engineering	3	1	0	4
8	25MHNR08	Computational Continuum Mechanics	3	1	0	4
9	25MHNR09	Heat Transfer Equipment Design	3	1	0	4
10	25MHNR10	Analysis and Design of Pressure Vessels	3	1	0	4
11	25MHNR11	Design and Analysis of Turbo Machines	3	0	0	3
12	25MHNR12	Analysis of Thermal Power Cycles	3	0	0	3
13	25MHNR13	Boiler Auxiliaries and Performance Evaluation	3	0	0	3
14	25MHNR14	Environmental Pollution Control	3	0	0	3

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Minor Degree Courses (offered for the students of other departments)

S.No	Course Code	Course Title	L	T	P	C
1.	25MMNR01	Basic Thermodynamics	3	0	0	3
2.	25MMNR02	Fundamentals of Thermal Engineering	3	0	0	3
3.	25MMNR03	Fluid Mechanics and Machinery	3	0	0	3
4.	25MMNR04	Fundamentals of Heat and Mass Transfer	3	0	0	3
5.	25MMNR05	Fundamentals of Automotive Technology	3	0	0	3
6.	25MMNR06	Fundamentals of Refrigeration and Air Conditioning	3	0	0	3
7.	25MMNR07	Principles of Turbomachinery	3	0	0	3
8.	25MMNR08	Fundamentals of Internal Combustion Engines	3	0	0	3
9.	25MMNR09	Engine Pollution and Control	3	0	0	3
10.	25MMNR10	Fundamentals of Dynamics	3	0	0	3
11.	25MMNR11	Fundamentals of Mechanical Design	3	0	0	3

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VERTICALS

Thermal	Manufacturing	Design	Materials	Industrial & Systems Engineering
Refrigeration & HVAC Systems	Digital Manufacturing	Computer-Aided Design and Prototyping	Selection of materials	Optimisation Techniques
Battery Technology	Industrial IoT	Tool Design	Composite Materials	Lean Manufacturing
Gas Dynamics and Jet Propulsion	Welding Engineering	Tribological Design	Fundamentals of Nanomaterials	Supply Chain Analytics
Vehicle Technology	Additive Manufacturing	Mechanical Vibrations	Nano Technology and Surface Engineering	Operations Research
Computational Fluid Dynamics	Theory of Metal Cutting	Design for Manufacturing and Assembly	Materials for Electronics	Quality Engineering
Renewable Energy Systems	Process Planning and Cost Estimation	Electric Vehicle Design	Materials Characterization	Life Cycle Assessment
Energy Conservation and Management	Non-traditional Machining Processes	Digital Twin	Mechanical Behaviour of Materials	Total Quality Management
Hybrid and Electric Vehicle Technology	Green Manufacturing Design and Practices	Integrated Product Design and Development	Surface Engineering	Industrial Safety
Thermal Management of Batteries and Fuel Cells	CAD/CAM and CIM	Ergonomics in Design	Failure Analysis and NDT Techniques	Environment Sustainability and Impact Assessment
Energy Saving Machinery and Components	Artificial Intelligence and Machine Learning in Manufacturing	Smart Mobility and Intelligent Vehicles	Automotive Materials and Testing	Value Engineering

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Sl.No	Course Code	DSR Activity	Course Registration	Evaluation Component	Credit
1	**25MDSR01**	**SUMMER INTERNSHIP** Industrial training/internship for a minimum period of four weeks during the summer vacation of III year (VI Semester).	along with the courses for VII semester	Report and viva-voce examination.	1
2	**25MDSR02**	**INDUSTRIAL LECTURE** A minimum of five lectures of two hours' duration by industry experts	along with the courses for IV semester	Attendance, quizzes at the end of each lecture	1
3	**25MDSR03**	**IDEA / PROOF OF CONCEPT / DESIGN THINKING** problem identification, design thinking and development of innovative solutions for real-world problem	along with the courses for V semester	Report and present their work before a departmental evaluation committee.	1
4	**25MDSR04**	**TECHNICAL SEMINAR / PUBLICATIONS / PARTICIPATION IN CONFERENCES** Students shall present a technical seminar, publish a technical article/paper or participate in technical conferences, workshops or symposiums approved by the Department.	along with the courses for VII semester	Documentary evidence in the form of publication details and/or participation certificates, and a presentation.	1
5	**25MDSR05**	**TECHNICAL CLUB ACTIVITY** Technical Club Coordinators shall organize, coordinate and document departmental/institutional technical club activities such	along with the courses for VII semester	Technical Club Activity Report with documentary evidence, presentation and viva-voce	1

		as workshops, seminars, guest lectures, technical competitions, project exhibitions, hackathons, industrial interactions and other approved technical events.		examination.	

Institute Requirement

Sl. No	Course Code	COURSE TITLE	CAT	Credit
1	25IR1001	**Induction Program** (All first-year students must attend the induction program to understand institute culture, ethics, and learning practices.)	HS	0
2	25IR1002	**Participation in Hackathon** (Students must participate in, at least one hackathon to encourage innovation, teamwork, and problem-solving aptitude.)	HS	0

Signature of HOD

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Semester I

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25ZES106 / 25YES204	**Engineering Graphics**	L	T	P	C
		1	0	4	3

Course Objectives:

- To impart knowledge on engineering drawing fundamentals, BIS/ISO conventions, and geometric constructions, enabling students to understand and represent technical information graphically.
- To develop the ability to visualize and draw orthographic projections of points, lines, planes, solids, sectioned solids, and their surface developments accurately using conventional and CAD tools.
- To train students in freehand sketching and the application of isometric and perspective projections for effective communication of engineering designs.

Plain Curve: Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves

Activities: Study on BIS/ISO conventions - Virtual Demonstration of Conics and Cycloids. (Only for CIE).

Projection of points, lines and plane surface: Orthographic projection-principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Activities: Practice first angle orthographic projection, draw projections of points and lines, determine true length and inclination, and construct projections of plane surfaces. (Only for CIE).

Projection of solids and freehand sketching: Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Activities: Development of models of various solids and virtual demonstration of

Free, CAD modelling of 2D objects. (Only for CIE).

Projection of sectioned solids and development of surfaces: Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Activities: create sectional views of prisms, pyramids, cylinders and cones to find the true shape of the section, prepare surface developments of solids, and perform basic 3D modelling of simple objects using CAD software. (Only for CIE)

Isometric and perspective projections: Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Activities: Conversion of 3D into 2D orthographic views, CAD modelling of 3D objects. (Only for CIE).

Lecture: 15, Practical:60, Total: 75 hours

Text Books:

1. Natrajan K. V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2016.

2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2016.

3.Shah, M.B and Rana B. C. “Engineering Drawing and Computer Graphics”, Pearson Education, 2010.

Reference Books:

1.N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University Press, New Delhi, 2015.

2. Gopalakrishna K.R, “Engineering Drawing” (Vol. I & II combined), Subhas publications, Bangalore, 2014.

3. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.

4. Luzzader, Warren J. and Duff John M., “Fundamentls of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Productiion”, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

5. Bhatt N. D. and Panchal V. M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition , 2014.

E-Resources:

https://onlinecourses.nptel.ac.in/noc21_me128/preview
https://nptel.ac.in/courses/112103019
https://onlinecourses.nptel.ac.in/noc22_me105/preview
https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/
https://onlinecourses.swayam2.ac.in/ntr25_ed52/preview

CO	Description of CO	Bloom's Level	POs	PSOs
CO1	Recall and explain the fundamentals of engineering graphics including BIS/ISO conventions, geometric constructions, engineering curves, orthographic projection principles, and visualization concepts used to represent engineering components graphically.	L1, L2	-	-
CO2	Apply graphical principles to construct projections of points, lines, planes, and solids, determine true length and inclinations, and develop surface representations of engineering objects using standard drawing procedures.	L3	PO1 (3)	PSO1 (2)
CO3	Analyze the geometric relationships involved in projections, sectional views, and developments of solids to interpret spatial configurations and graphical transformations in engineering design.	L4	PO2 (3), PO7 (1)	PSO1 (2), PSO3 (1)
CO4	Examine and interpret engineering components through isometric and perspective projections, evaluating multiple views and graphical representations to support effective technical communication and visualization.	L4	PO2 (2), PO9 (2)	PSO1 (2)
CO5	Implement, evaluate, and create graphical models and engineering representations through drawing practice, freehand sketching, CAD modelling, projection exercises, and visualization activities to develop professional communication, teamwork, and digital design competence.(Only for CIE).	L4, L5, L6, L7	PO5 (3), PO11 (2), PO9 (2)	PSO1 (2), PSO2 (2)

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25ZES110 / 25ZES208	**Engineering Practices Laboratory**	L	T	P	C
		0	0	4	2

Course Objectives:

To introduce basic manufacturing and fabrication processes such as welding, machining, foundry, and additive manufacturing, and enable students to gain hands-on skills.

To expose students to civil engineering practices such as plumbing, woodwork, and construction-related fittings used in domestic and small-scale structures.

To familiarize students with fundamental computer operations including hardware assembly, operating system installation, and essential software applications for documentation and data processing

PART I: MECHANICAL ENGINEERING PRACTICES

Welding Work:

Welding of Butt Joints, Lap Joints, and Tee Joints using SMAW welding. &

Practicing GMAW welding.

Practicing GTAW welding.

Basic Machining Work:

Simple Turning,

Simple Drilling

Simple Tapping.

Assembly Work:

Assembling a centrifugal pump

Assembling a household mixer

Assembling an air-conditioner.

Sheet Metal Work:

Making of a square tray or Dust Pan or Fabrication of Corner Tray

Additive Manufacturing:

Modeling and printing of solid Cone or any shape using 3D printing

Foundry Work:

Demonstrating basic foundry operations.

PART II: CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

Connecting various basic pipe fittings like valves, taps, coupling, unions,- reducers, elbows and other components which are commonly used in household.

- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
- WOOD WORK:
- Sawing, Planing
- Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.
- Wood Work Study:
- Studying joints in door panels and wooden furniture
- Studying common industrial trusses using models.

PART III: COMPUTERS

- Demonstration of Computer or Laptop Peripherals and Preparation of CPU Block Diagram.
- Installation of Linux and Windows Operating Systems and Dual Boot Configuration.
- Document Creation and Formatting using MS Word.
- Spreadsheet Operations using MS Excel.
- Presentation Creation using MS PowerPoint.
- Document Structure and Table Creation using LaTeX.
- Insertion of Figures, Equations, and References using LaTeX.
- Newsletter Design using MS Word.
- GPA Calculation of Students using MS Excel.

Practical: 60 hours

Reference:

1. R.K. Rajput, Workshop Practice, Laxmi Publications (P) Limited, 2009.

2.Shashi Kant Yadav, Workshop Practice, Discovery Publishing House, New Delhi, 2006

3.T. Jeyapoovan and S. Saravana Pandian, Engineering Practices Laboratory Manual, Vikas Publishing House Pvt. Ltd., 2023.

4.P. N. Rao, Manufacturing Technology – Volume I, McGraw Hill Education (India) Pvt. Ltd., 4th Edition, 2022.

5.S. Kalpakjian and S. R. Schmid, Manufacturing Engineering and Technology, Pearson Education, 8th Edition, 2020.

6.W. A. J. Chapman, Workshop Technology – Volume I, Routledge / Elsevier, 2021 Edition.
7.Reema Thareja, Computer Fundamentals and Applications, Oxford University Press, 2021 Edition.

E-Resources:

https://onlinecourses.nptel.ac.in/noc22_me121/preview
https://onlinecourses.nptel.ac.in/noc24_me46/preview
https://onlinecourses.nptel.ac.in/noc24_me115/preview
https://ocw.mit.edu/courses/3-37-welding-and-joining-processes-fall-2002/
https://ocw.mit.edu/courses/2-670-mechanical-engineering-tools-january-iap-2004/

CO	Description of CO	Bloom's Level	POs	PSOs
CO1	Demonstrate and describe the safe use of tools, equipment, materials, and standard procedures involved in welding, machining, assembly, sheet metal work, foundry operations, plumbing systems, wood work, and computer laboratory practices.	L1, L2	-	-
CO2	Perform basic engineering practice operations including welding joints, machining processes, sheet metal fabrication, mechanical assemblies, plumbing connections, wood joints, and computer-based tasks using appropriate methods and tools.	L3	PO1 (3), PO3 (2)	PSO2 (2)
CO3	Examine and analyze workshop practices and laboratory procedures such as fabrication, assembly mechanisms, plumbing layouts, wooden joint structures, and computer documentation techniques to interpret their engineering functions.	L3, L4	PO3 (3), PO1 (2)	PSO2 (2), PSO3 (1)
CO4	Evaluate and integrate practical engineering activities by utilizing modern tools and computing platforms to prepare technical documents, spreadsheets, presentations, and structured reports while working effectively in teams.	L4, L5	PO5 (3), PO8 (2) PO11 (2),	PSO1 (2), PSO2 (2)

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Semester II

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25MES205	Engineering Mechanics	L	T	P	C
		3	1	0	4

Course Objectives:

Understand and apply fundamental concepts of statics for particles and rigid bodies to analyze equilibrium in two and three dimensions.

Calculate centroids, centers of gravity, and moments of inertia for various bodies and composite shapes using analytical methods.

Analyze the kinematics and kinetics of particles using Newton's laws, work-energy, and impulse-momentum principles.

Evaluate the effects of dry friction and solve related mechanical system problems involving wedges, wheels, and ladders.

Model and simulate simple static and dynamic rigid body problems using ADAMS software to complement theoretical knowledge.

Statics of particles: Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

Activities: Quizzes on concepts and units, interpret force info graphics, prepare flow diagrams, and solve numerical and GATE problems on resultant and equilibrium. (Only for CIE)**.**

Equilibrium of rigid bodies: Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force –Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections**.**

Activities: Identify moments and couples from diagrams, interpret info graphics, prepare flow diagrams for equilibrium, solve quizzes and puzzles, and practice numerical and GATE problems on reactions and rigid body equilibrium. (Only for CIE).

Distributed forces: Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite

Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

Activities: Interpret centroid and moment of inertia info graphics, analyze composite shapes, prepare flow diagrams, solve quizzes and puzzles, and practice numerical and GATE problems on centroids and inertia. (Only for CIE).

DYNAMICS OF PARTICLES : Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

Activities: Solve quizzes and puzzles, and practice numerical and GATE problems on dynamics. (Only for CIE).

Friction: The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

Introduction to ADAMS software – modeling of Simple Rigid Bodies – simulation of simple static and dynamic rigid body problems using ADAMS tool.

Activities: Analyze motion diagrams, interpret work–energy and momentum infographics, prepare flow diagrams, solve quizzes and puzzles, and practice numerical and GATE problems on dynamics. (Only for CIE).

Lecture: 45, Tutorial: 15, Total: 60 hours

Text Books:

1. Beer F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 11th Edition, Tata McGraw-Hill Publishing company, New Delhi (2015).

2. Bhavikatti S. S. and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 2017.

3. Natesan, S.C., "Engineering Mechanics", Umesh publications, New Delhi, 2002

4. Dr.D.S.Kumar., "Engineering Mechanics", Katson Books, 2013

Reference Books:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.

2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.

3. Meriam J. L. and Kraige L. G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", 4th Edition, John Wiley & Sons,1996.

4. Rajasekaran S. and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics",3rd Edition, Vikas Publishing House Pvt. Ltd., 2009.

5. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata

McGraw-Hill Publishing company, New Delhi 2008.

E-Resources:

https://nptel.ac.in/courses/112106286
https://onlinecourses.nptel.ac.in/noc21_ce52/preview
https://onlinecourses.nptel.ac.in/noc22_me105/preview
https://ocw.mit.edu/courses/2-01sc-engineering-dynamics-fall-2011
https://ocw.mit.edu/courses/2-003sc-engineering-dynamics-fall-2011
https://www.coursera.org/learn/engineering-mechanics-statics
https://www.coursera.org/learn/engineering-mechanics-dynamics
https://www.edx.org/learn/engineering-mechanics

CO	Description of CO	Bloom's Level	PO	PSO
CO1	Recognize and describe the fundamental concepts of engineering mechanics including systems of units, force systems, equilibrium conditions, distributed forces, particle motion, and friction principles.	L1, L2	-	-
CO2	Implement mechanics principles to determine resultants, force components, equilibrium conditions, centroids, moments of inertia, and motion parameters for statics and dynamics problems.	L3	PO1 (3), PO2 (2)	PSO1 (2)
CO3	Interpret and investigate equilibrium of rigid bodies, distributed force systems, centroid locations, inertia properties, and particle dynamics using engineering mechanics concepts.	L4	PO2 (3), PO3 (2)	PSO1(2), PSO3 (1)
CO4	Utilize and examine mechanics principles to address engineering problems involving statics, dynamics, friction, and rigid body systems through appropriate analytical methods.	L4,L5	PO1 (2), PO2 (2), PO3 (2)	PSO1(2), PSO3 (1)
CO5	Develop, assess, and construct solutions through quizzes, puzzles, infographics, flow diagrams, GATE-level problem solving, and simulation of rigid body problems using ADAMS software while presenting outcomes effectively.(Only for CIE)	L3, L4, L5, L6	PO4 (2), PO5 (3), PO9 (2), PO11 (2)	PSO1(2), PSO2 (2)

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SEMESTER III

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Subject Code	**25MBS301**	**Subject Title**	PROBABILITY AND STATISTICS
Category	Basic science	**L-P-T-C**	3-0-1-4
Regulation	2025	**Semester**	III
Prerequisites	Basic knowledge of calculus (differentiation and integration) and probability / statistics.		

Course Objectives:

1. To understand and apply fundamental concepts of probability, random variables, and common probability distributions.
2. To analyze joint, marginal, and conditional distributions and study correlation and regression techniques.
3. To develop and apply estimation methods such as maximum likelihood, method of moments, and least squares for parameter estimation.
4. To perform hypothesis testing for population parameters, including goodness-of-fit and contingency table tests.
5. To apply principles of experimental design and analyze variance (ANOVA) for different experimental setups such as randomized blocks and Latin squares.

COURSE CONTENT:

[PROBABILITY AND RANDOM VARIABLES] (9+3)

Axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

[TWO – DIMENSIONAL RANDOM VARIABLES] (9+3)

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and linear regression – Transformation of two-dimensional random variables.

[ESTIMATION THEORY] (9+3)

Unbiased estimators – Method of Maximum Likelihood Estimation – Method of Moments – Curve fitting by the Principle of Least Squares – Fitting a straight line – Fitting a parabola.

[TESTING OF HYPOTHESIS] (9+3)

Introduction – Parameters and Statistics – Sampling Distributions – Tests of Hypothesis: Test for Single Mean – Test for Proportion – Test for Difference of Means – Chi-square Test: Goodness of Fit and Test for Independence of Attributes.

[DESIGN OF EXPERIMENTS] (9+3)

Basic Principles of Experimental Design – Completely Randomized Design – Randomized Block Design – Latin Square Design.

Total Hours:60

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	Recall fundamental definitions, formulas, and concepts of probability, random variables, estimation methods, hypothesis testing, and experimental design.	L1
CO2	Explain probability distributions, joint and marginal distributions, estimation procedures, sampling distributions, and the principles of experimental design.	L2
CO3	Apply probability laws, statistical estimation methods, hypothesis tests, and ANOVA techniques to solve statistical problems.	L3
CO4	Analyze relationships between variables using correlation, regression, and transformations, and evaluate statistical models and test results.	L4
CO5	Evaluate statistical results and select appropriate experimental designs for real-world data analysis.	L5

Text Books:

1. Thilagavathy, K., Kandasamy, P., and Gunavathi, K., "Statistical and Numerical Methods", S. Chand & Company Ltd., New Delhi, 2010.
2. Veerarajan, T., Probability, "Statistics and Random Processes", Tata McGraw-Hill Education, New Delhi, 2013.
3. Gupta, S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2020.

Reference Books:

1. Johnson, R.A., Miller, I., and Freund, J.E., "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education Asia, 2015.
2. Johnson, R.A., and Wichern, D.W., "Applied Multivariate Statistical Analysis", 6th Edition, Pearson Education Asia, 2007.
3. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, 2016.
4. Grewal, B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.

E-resources:

1. https://nptel.ac.in/courses
2. https://nptel.ac.in/courses/111106112
3. https://www.khanacademy.org/math/statistics-probability

Course Articulation matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	2	1	-	-	-	-	-	-
CO4	3	3	2	3	1	-	-	-	-	-	-
CO5	3	3	3	3	1	-	-	-	-	-	-

CorrelationLevels:3- Strong,2- Medium,1 -Low, - (dash)-No correlation

Course Designed By

12/3/26 (S. Gowtham Prakash) AP(T)/MAT

12/3/26 (S. VADIVEL) AP(T)/Maths

12-03-26. (Dr. D. BABU ASP/Mathematics, TPGIT, Vellore)

BOS Approval
Date: 12/3/26

25MPC302	**Engineering Thermodynamics**	L	T	P	C
		3	1	0	4

Course Objectives:

To develop fundamental understanding of thermodynamic principles, laws and processes involved in engineering systems and energy interactions.

To enable students to analyze thermodynamic behavior of pure substances, ideal and real gases, entropy, availability and energy conversion systems using property relations and thermodynamic charts.

To enhance the ability of students to evaluate, interpret and apply thermodynamic concepts for solving engineering problems related to energy efficiency, irreversibility and sustainable thermal systems. (Activities only for CIE).

Basics, zeroth and first law: Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law – Concept of temperature and Temperature Scales. First law – application to closed and open systems – steady and unsteady flow processes.

Activities: Energy audit assignment on thermodynamic system efficiency and cost savings / Quiz & GATE question solving / Seminar presentation on energy balance research articles. (Activities only for CIE).

Second law and entropy: Heat Engine – Refrigerator – Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle – Reversed Carnot cycle – Performance – Clausius inequality. Concept of entropy – T-s diagram – Tds Equations – Entropy change for a pure substance.

Activities: Student demonstration of Heat Engine and Vapour Compression Refrigeration System (VCRS) / Graphical representation and interpretation of T-s diagrams for thermodynamic cycles / Assignment on comparison of heat engines, refrigerators and heat pumps / Solving of GATE problems related to Second Law and entropy calculations / Seminar on research papers related to entropy analysis and Second Law. (Activities only for CIE).

Availability and applications of II law: Ideal gases undergoing different processes - principle of increase in entropy. Applications of II Law. High and low-grade energy. Availability and Irreversibility for open and closed system processes - I and II law Efficiency

Activities: Open-ended numerical design problem on exergy and irreversibility / Case study discussion on energy degradation and efficiency improvement in thermal systems / Assignment on comparison of first law efficiency and second law efficiency / Solving of GATE questions related to exergy and irreversibility / Research paper presentation on exergy applications by students. (Activities only for CIE).

Properties of pure substances: Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart

Activities: Numerical problem-solving using steam tables and Mollier chart / Plotting thermodynamic processes on T-s and h-s diagrams / Assignment on determination of dryness fraction and steam quality / Solving of GATE questions related to steam properties and phase diagrams / Standards & code-based assignment using steam property charts and ASME references. (Activities only for CIE).

Gas mixtures and thermodynamic relations: Properties of Ideal gas, real gas - comparison. Equations of state for ideal and real gases. Vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states – Generalized Compressibility Chart. Maxwell relations - tds Equations - heat capacities relations - Energy equation, Joule- Thomson experiment - Clausius-Clapeyron equation.

Activities: Assignment on comparison of ideal gas and real gas behavior / Analytical exercises on Maxwell relations and thermodynamic property relations / Solving of GATE questions related to real gas equations and Joule–Thomson effect / Literature survey on thermodynamic relations and real gas behavior. (Activities only for CIE).

Lecture: 45, Tutorials: 15, Total: 60 hours

Text books:

Nag P.K., “Engineering Thermodynamics”, 6th Ed., Tata McGraw - Hill, Delhi, 2017.

Rajput R.K. “Thermal Engineering” Laxmi Publications 8th Edition. 2010.

Dr.D.S.Kumar., “Engineering Thermodynamics”, Katson Books, 2012.

Reference:

Kothandaraman C.P., “Thermal Engineering”, DhanpatRai& Sons, 2013.

Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.

Yunus Cengel, “Thermodynamics” Tata McGraw - Hill Company, 8th Edition, 2014.

Ballaney P.L., “Thermal Engineering”, Khanna Publisher. 1996.

Mahesh. M. Rathore, “Thermal Engineering”, Tata McGraw - Hill Education Private Limited 1st edition, 2010.

Holman J.P., “Thermodynamics” Tata McGraw - Hill Company, 2000.

E-Resources:

https://nptel.ac.in/courses/112105266

https://onlinecourses.nptel.ac.in/noc22_me39/preview

https://onlinecourses.nptel.ac.in/noc23_me65/preview

https://ocw.mit.edu/courses/2-05-thermodynamics-fall-2013

https://www.coursera.org/learn/thermodynamics

https://www.edx.org/learn/thermodynamics

https://www.khanacademy.org/science/physics/thermodynamics

https://learncheme.com/thermodynamics/

CO	Course Outcome	Bloom's Level	POs	PSOs
CO1	Recall and explain the fundamental concepts, laws, properties, processes, thermodynamic relations and working principles associated with thermodynamic systems, entropy, availability, steam properties and gas mixtures.	L1, L2	-	-
CO2	Apply thermodynamic principles, laws, property relations, equations and charts to solve engineering problems involving energy transfer, entropy, steam properties, gas mixtures and thermodynamic processes.	L3	PO1	PSO 1
CO3	Analyze the behavior and performance of thermodynamic systems, cycles, availability, irreversibility, pure substances and real gas processes under varying operating conditions using First and Second Law concepts.	L4, L5	PO2	PSO 1
CO4	Evaluate and develop suitable thermodynamic models, energy-efficient solutions and analytical approaches for engineering applications involving entropy, exergy, steam systems, gas mixtures and thermodynamic relations.	L6	PO3 , PO5, PO7	PSO 2
CO5	Recall and explain the fundamental concepts, laws, properties, processes, thermodynamic relations and working principles associated with thermodynamic	L1, L2	-	-

	systems, entropy, availability, steam properties and gas mixtures.			

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25MPC303	**Strength of Materials & Testing**	**L**	**T**	**P**	**C**
		3	0	2	4

Course Objectives:

- To understand the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior
- To construct shear force and bending moment diagrams for various beam configurations subjected to different loading conditions.
- To analyze bending stresses in beams and evaluate two-dimensional stress states, including principal stresses, strains, and stress transformation using Mohr's circle.
- To Apply analytical methods to determine slope and deflection of beams and evaluate the buckling behaviour and load carrying capacity of columns using Euler and Rankine theories.
- To Evaluate the torsional response of shafts and helical springs by determining stresses, angle of twist, power transmission, strain energy, and effects of combined bending and torsion.

Stress and strain: Stress and strain at a point-tension, compression, shear stresses - Hooke's law - compound bars – lateral strain - Poisson's ratio - volumetric strain - bulk modulus - relationship among elastic constants – stress strain diagrams for mild steel, cast iron-ultimate stress - yield stress-factor of safety - thermal stresses - thin cylinders - strain energy due to axial force - resilience- stress due to gradual load, suddenly applied load and impact load.

Activities: MCQ quiz on stress–strain concepts, identify stress–strain curve parts, lab demo on tensile and compression test, solving GATE problems on stress, strain and thermal stress, concept puzzle on factor of safety, graphical study of stress–strain behaviour, ANSYS/ADAMS simulation of tensile and compression behaviour.(Only for CIE).

Shear force and bending moment: Beams – types of beams - types of loads, supports - shear force – bending moment – shear forces and bending moment diagrams for cantilever, simply supported and over hanging beams with concentrated , uniformly distributed and uniformly varying load-relationship between rate of loading, shear force, bending moment- point of contra flexure.

Activities: Identify beam types, loads and supports, Draw shear force and bending moment diagrams, MCQ quiz on beam reactions, solving GATE problems on SFD and BMD.Lab demo on beam loading conditions,puzzle on point of contraflexure, ANSYS/ADAMS simulation of beam bending behaviour. (Only for CIE).

Theory of bending and complex stresses: Theory of bending-bending equation-section modulus-stress distribution at a cross section due to bending moment and

shear force for cantilever, simply supported beams with point, UDL loads (rectangular, circular, I & T sections only) -combined direct and bending stresses, kernel of section (rectangular, circular sections only). 2D state of stress – 2D normal and shear stresses on any plane-principal stresses and principal planes-principal strains and direction-Mohr's circle of stress.

Activities: MCQ quiz on bending equation and section modulus, solving GATE problems on bending stress and combined loading, lab demo on bending of beams. Flowchart for bending stress calculation, puzzle on kernel of section, graphical study of stress distribution, ANSYS/ADAMS simulation of beam stress analysis, study of Mohr's circle using CAD. (Only for CIE).

Deflection of beams and theory of long columns: Determinations of deflection curve – relation between slope, deflection and radius of curvature – slope and deflection of beam at any section by double integration, Moment Area and Macaulay's method - concept of conjugate beam method (theory only)- Euler's theory of long columns- expression of crippling load for various end conditions-effective length-slenderness ratio- limitations of Euler equation - Rankine formula for columns.

Activities: MCQ quiz on beam deflection methods, solving GATE problems using double integration and moment area methods, lab demo on beam deflection and column buckling. Flowchart for Euler column calculations, puzzle on effective length and slenderness ratio, graphical study of buckling behaviour, ANSYS/ADAMS simulation of beam deflection. (Only for CIE).

Theory of torsion: Torsion of shafts - torsion equation - polar modulus- stresses in solid and hollow circular shafts - torsional rigidity - power transmitted by the shaft – importance of angle of twist - strain energy due to torsion - modulus of rupture – torsional resilience – combined bending and torsion- stresses in helical springs - deflection of helical spring.

Activities: Observe torsion in shafts and springs, MCQ quiz on torsion equation and polar modulus, solving GATE problems on torsional stress and power transmission, lab demo on spring and shaft twisting. Flowchart for torsion calculations, puzzle on torsional rigidity and angle of twist, graphical study of torsional stress distribution, ANSYS/ADAMS simulation of spring and torsion behavior of shaft. (Only for CIE).

Practical:

1. Tension test on mild steel rod.
2. Hardness test on metal (Rockwell and Brinell hardness).
3. Impact test (Charpy & Izod).
4. Deflection test on carriage spring.
5. Deflection test on carriage spring.
6. Torsion test on mild steel rod.

Lecture: 45, Practical: 30, Total: 75 hours

Text books:

1. Bansal R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2018
2. Ramamrutham S and Narayan R, "Strength of Materials", Dhanpat Rai and Sons, New Delhi, 2000.

References books:

1. Hibbeler R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
2. Jindal U C, “Textbook on Strength of Materials”, Asian Books Pvt. Ltd., Learning India, 2013.
3. EgorP.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series,
5. Sadhu Singh, “Strength of Materials”,Khanna Publishers, New Delhi, 2016

E-Resources:

https://nptel.ac.in/courses/112107147
https://ocw.mit.edu/courses/2-001-mechanics-materials-i-fall-2006
https://mechanicalc.com/reference/strength-of-materials
https://www.engineer4free.com/mechanics-of-materials.html
https://mathalino.com/reviewer/mechanics-and-strength-of-materials
https://www.learnengineering.org/strength-of-materials.html

CO	Description of CO	Bloom’s Level	POs	PSOs
CO1	Explain the fundamental concepts of stress–strain behaviour, shear force and bending moment relationships, bending stresses and complex stress states, beam deflection and column stability, and torsional behaviour of shafts and springs in mechanical structures.	L1, L2	–	–
CO2	Implement engineering principles to determine stresses, strains, shear forces, bending moments, beam deflections, column loads and torsional stresses for mechanical structural elements subjected to various loading conditions.	L3	PO1 (3)	PSO1 (2)
CO3	Investigate the behaviour of structural members by evaluating stress distribution, beam bending characteristics, complex stress states using	L4	PO2 (3), PO3 (2)	PSO1 (2)

	Mohr's circle, deflection behaviour of beams and stability of columns under different loading conditions.			
CO4	Evaluate the performance of mechanical structural components by analysing beam deflection, column buckling behaviour, torsional effects in shafts and springs and the combined effects of bending and torsion in engineering systems.	L4	PO2 (2), PO3 (3), PO4 (2)	PSO1(2), PSO2(1), PSO3(1)
CO5	Employ, analyse and assess engineering concepts through laboratory experiments, analytical calculations, diagram interpretation, case studies and solving GATE-based problems related to stress analysis, beam behaviour, column stability and torsion.(Only for CIE)	L3, L4, L5	PO5 (3), PO9 (2), PO10 (2)	PSO2 (2), PSO3(1)

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25MPC304	Manufacturing Processes	L	T	P	C
		3	0	0	3

Course objectives:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To analyze the working principles of bulk deformation of metals.
- To learn the working principles of sheet metal forming process.
- To study and practice the working principles of plastics molding.

Metal casting processes: Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores – Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – low pressure, gravity- Tilt pouring, high pressure die casting- Centrifugal Casting – CO_2 casting –- Defects in Sand casting process- remedies.

Activities: Identify the components of sand moulding, Label the parts of a sand mould diagram**,** Mini demonstration of sand mould preparation, Identifying casting defects from pictures, solving competitive exam questions on casting concepts, Flowchart creation for sand casting steps.(Only for CIE).

Metal joining processes: Fusion welding processes – Oxy fuel welding – Filler and Flux materials-–Arc welding, Electrodes, Coating and specifications – Gas Tungsten arc welding –Gas metal arc welding - Submerged arc welding – Electro slag welding– Plasma arc welding –– Resistance welding Processes -Electron beam welding –Laser beam Welding Friction welding – Friction stir welding – Diffusion welding – Thermit Welding, Weld defects – inspection &remedies – Brazing - soldering – Adhesive bonding.

Activities: Weld defect identification from images, solving competitive exam questions on welding principles, Group discussion on advantages of TIG vs MIG welding – Short presentation on industrial welding applications, Diagram labeling of TIG and MIG welding setups.(Only for CIE).

Bulk deformation processes: Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – cold forging- Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Introduction to shaping operations.

Activities: Quiz on hot working vs cold working, Flowchart activity for rolling process steps, Puzzle on rolling defects, Group presentation on industrial forging applications, and Case study discussion on rolling mill defects. (Only for CIE).

Sheet metal processes: Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming – Incremental forming.

Activities: Identify sheet metal operations from images, Paper Bending Activity – Observe springback practically, Match forming process with industrial product, MCQ Quiz – Blanking vs Punching difference, Short quiz on sheet metal defects. . (Only for CIE).
Manufacture of plastic components: Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers– working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics- duff moulding. **Activities:** MCQs on injection moulding cycle, Flowchart Drawing – Injection moulding cycle steps, Small demo model explanation of molding cycle, GATE question solving on polymer processing.(Only for CIE)..
Lecture: 45
TEXT BOOKS: 1..Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,4th Edition, 2013 2.P.N .Rao Manufacturing Technology Volume 1 Mc Grawhill Education 5th edition,2018 **REFERENCES:** 1.Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006. 2.S.Gowri P. Hariharan, A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008. 3.P ul Degarma E, Black J.T and Ronald A. Kosher, Eligth Edition, Materials and Processes, in Manufacturing, Eight Edition, Prentice – Hall of India, 1997. 4.Hajra Chouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997 5.Sharma, P.C., A Text book of production Technology, S.Chand and Co. Ltd., 2004
E-resources: https://archive.nptel.ac.in/courses/112/104/112104301/?utm_source=chatgpt.com https://pandianprabu.weebly.com/manufacturing-processes.html?utm_source=chatgpt.com https://edurev.in/t/468833/Summary-Metal-Casting?utm_source=chatgpt.com

	Course Outcome	Bloom's Level	POs,	PSOs
CO1	Explain the basic principles, materials, equipment, and process characteristics involved in metal casting, metal joining, bulk deformation, sheet metal forming, and plastic component manufacturing.	L1, L2	-	-
CO2	Apply engineering fundamentals to select suitable manufacturing processes such as casting, welding, metal forming, sheet metal operations, and plastic molding for producing mechanical components.	L3	PO1(3)	PSO2(2)
CO3	Analyse manufacturing process parameters, defects, and operational characteristics in casting, welding, forming, and plastic processing to improve product quality and manufacturing efficiency.	L4	PO2(3), PO3(2)	PSO1(2)
CO4	Evaluate and design appropriate manufacturing methods and process conditions for mechanical components considering productivity, quality, and industrial requirements.	L5, L6	PO2(2), PO3(3), PO4(2)	PSO2(3), PSO3(2)
CO5	Apply, analyse, and evaluate manufacturing processes through classroom activities such as quizzes, demonstrations, model making, problem solving, and case studies to understand practical manufacturing practices	L3, L4, L5	PO5(3), PO9(3), PO11(2)	-

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25MES305	Engineering Codes and Standards	L	T	P	C
		2	0	0	2

Course Objectives:

To introduce the fundamentals of engineering standards, drawing conventions, GD&T and tolerance analysis used in engineering design and manufacturing.

To familiarize students with measurement, inspection and material testing standards including limits and fits, surface measurement techniques, CMM, and ASTM testing standards.

To provide awareness of industrial design codes, quality systems and safety standards such as ASME BPVC, ISO quality management systems, OSHA safety regulations, and basic statistical quality control methods.

Engineering Drawing and Standards: Engineering Drawing and Standards: Engineering standards and standard organizations such as ASME, ISO, ASTM, ANSI and BIS. Engineering drawing practices including dimensioning, symbols and notations. ASME Y14.5 standard for dimensioning and tolerancing. Basics of Geometric Dimensioning and Tolerancing (GD&T) including form, orientation, location and run-out tolerances. Importance of tolerance analysis and interchangeability in design and manufacturing.

Activities: Identify different standard organizations (ASME, ISO, ASTM, BIS) from examples. Interpret GD&T symbols from sample engineering drawings. Short quiz or MCQ activity on ASME Y14.5 and drawing standards.

Metrology and Inspection: Measurement standards used in manufacturing industries. Limits, fits and tolerances and their role in assembly and interchangeability. Types of fits such as clearance, transition and interference fits. Basics of surface roughness measurement and dimensional inspection methods. Working principles and applications of Coordinate Measuring Machines (CMM) in quality control.

Activities: Demonstration or video observation of CMM measurement process. Solve simple limits, fits and tolerance problems. Identify surface roughness symbols and measurement methods.

Materials Standards and Testing: Material testing standards with emphasis on ASTM standards. Standard procedures for tensile testing, hardness testing and impact testing. Stress–strain behavior and interpretation of test results. Common hardness testing methods such as Brinell, Rockwell and Vickers tests. Importance of standardized testing in ensuring material quality and reliability.

Activities: Identify ASTM testing standards used for tensile, hardness and impact tests. Demonstration/video observation of material testing procedures. Short activity on interpreting stress–strain curve from tensile test data.

Manufacturing and Safety Standards: ISO 9001 quality management systems used in manufacturing industries. Process standardization, quality documentation and quality assurance practices. Industrial safety standards and workplace safety practices. OSHA regulations related to hazard identification, accident prevention and safe working environments.

Activities: Case discussion on ISO 9001 quality system implementation in industry. Identify industrial safety symbols and OSHA guidelines. Prepare a short flowchart of manufacturing quality documentation process.

Design Codes and Quality Engineering: Engineering design codes used to ensure safety and reliability of engineering systems. ASME Boiler and Pressure Vessel Code (BPVC) and basic piping standards. Statistical Quality Control (SQC) methods including control charts and process monitoring. Basic reliability engineering concepts and quality improvement practices.

Activities: Identify applications of ASME BPVC and piping standards in engineering systems. Solve simple Statistical Quality Control problems using control charts. Short activity on reliability and quality improvement concepts**.**

Lecture: 30 hours

Text Books:

1.Ashok Kumar, Simplified GD&T: Based on ASME Y14.5, Amazon Digital Services, 2018.

2.James D. Meadows, Geometric Dimensioning and Tolerancing: Applications, Analysis & Measurement, ASME Press.

Reference Books:

1. Gene R. Cogorno, Geometric Dimensioning and Tolerancing for Mechanical Design, McGraw-Hill Education.

2. E. Oberg, F. D. Jones, H. L. Horton, Machinery's Handbook, Industrial Press.

3. J. P. Holman, Experimental Methods for Engineers, McGraw-Hill.

4. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley.

5. ASME Standards, ASME Y14.5 – Dimensioning and Tolerancing Standard.

E-Resources:

https://www.asme.org/codes-standards/find-codes-standards/y14-5-dimensioning-tolerancing

https://www.asme.org/codes-standards/find-codes-standards/bpvc

https://www.astm.org/standards

https://www.iso.org/iso-9001-quality-management.html

https://www.osha.gov/laws-regs

https://www.ansi.org/standards
https://www.bis.gov.in

CO	Description of CO	Bloom's Level	POs	PSOs
CO1	Explain the fundamental concepts of engineering standards including drawing standards, ASME Y14.5, GD&T, measurement standards, limits and fits, and ASTM material testing methods used in engineering applications.	L1, L2	-	-
CO2	Apply the principles of metrology, inspection techniques, material testing standards, and quality systems such as ISO standards in engineering design and manufacturing practices.	L3	PO1 (2), PO2 (2),	PSO1(2), PSO2 (1)
CO3	Describe the importance of engineering design codes and safety standards including ASME BPVC, piping standards, OSHA safety regulations, and Statistical Quality Control concepts used in industries.	L2, L3	PO2 (2), PO3 (1), PO6 (1),	PSO1(1), PSO2(2),
CO4	Perform learning activities related to engineering standards such as identifying GD&T symbols, solving limits and fits problems, observing CMM and material testing demonstrations, analyzing ISO and OSHA standards, and interpreting simple Statistical Quality Control charts.	L3, L4	PO5(2) PO9(1) PO10(1)	PSO(2), PSO(1)

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25MES307	Engineering Materials and Metallurgy	L	T	P	C
		3	0	2	4

Course objectives:

- To learn the constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
- To learn selecting and applying various heat treatment processes and its microstructure formation.
- To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field.
- To illustrate the different polymer, ceramics and composites and their uses in engineering field.
- To learn the various testing procedures and failure mechanism in engineering field.

Constitution of alloys and phase diagrams: Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast-Iron microstructure, properties and application.

Activities: Solving competitive exam question (lever rule), Puzzle on microstructure with material, mcqs on eutectic, eutectoid reactions, Label the Iron–Iron Carbide phase diagram, lowchart creation: phase transformation steps during cooling. *(Only for CIE).*

Heat treatment: Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

Activities: Draw TTT/CCT diagram and interpret cooling curves, MCQ quiz on annealing, normalizing, hardening, tempering, Case study**:** selecting heat treatment for gears, Match heat treatment process with purpose. *(Only for CIE).*

Ferrous and non-ferrous metals: Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications-overview of materials standards

Activities: Alloy element identification quiz (Mn, Cr, Ni effects), Solving competitive exam question on stainless/tool steels, Group discussion: Why superalloys in turbines?, Short presentation on titanium alloys. *(Only for CIE).*

Non-metallic materials: Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers – Urea and Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of

Al2O3, sic, Si3N4, PSZ and SIALON – intermetallics- Composites- Matrix and reinforcement Materials-applications of Composites - Nano composites.

Activities: mcqs on engineering polymers, Simple composite demo model (paper + glue as matrix & fiber), Case study: Select composite for automobile panel, Concept puzzle on matrix and reinforcement materials. *(*Only for CIE).

Mechanical properties and deformation mechanisms: Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

Activities: Stress–strain curve drawing and labeling quiz, Solving competitive exam question on hardness/impact test, Fracture mode identification puzzle, Case study on creep failure in turbine blades.*(*Only for CIE).

EXPERIMENTS

1. Metallurgical characterization technics : Principles and Operations
2. Specimen Preparation techniques for Metallographic Analysis
3. Microstructural Analysis of Carbon Steels
4. Microstructural Analysis of Cast Irons
5. Microstructural Analysis of Stainless steel
6. Microstructural Analysis of Non-Ferrous Metals
7. Standard test Methods for Estimation of Grain Size

Lecture: 45, Practical: 30, Total: 75 hours

Text books:

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th edition ,2018.
2. Sydn ey H.Avner, "Introduction to Physical Metallurgy", mcgraw Hill Book Company, 1994

References:

1. A. Alavudeen, N. Venkateshwaran, and J. T.winowlinjappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006..
2. Am andeep Singh Wadhwa, andharvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.
3. G.S . Upadhyay and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt.Ltd, New Delhi, 2020.
4. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt.Ltd. 6th edition, 2019
5. Wil liams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, 2nd edition Reprint 2019

E-resources:

https://nptel.ac.in/courses/11310805, https://nptel.ac.in/courses/113108052
https://onlinecourses.nptel.ac.in/noc23_mm01/preview,
https://onlinecourses.nptel.ac.in/noc22_mm08/preview
https://ocw.mit.edu/courses/3-012-fundamentals-of-materials-science-fall-2005
https://ocw.mit.edu/courses/3-091sc-introduction-to-solid-state-chemistry-fall-2010
https://www.coursera.org/learn/materials-science,
https://www.edx.org/learn/materials-science

	Course Outcome	Bloom's Level	POs	PSOs
CO1	Explain the constitution of alloys, phase diagrams, heat treatment processes, types of ferrous and non-ferrous materials, non-metallic materials, and mechanical properties of engineering materials.	L1, L2	-	-
CO2	Apply principles of phase diagrams, heat treatment, and mechanical property evaluation to interpret material behavior and select suitable engineering materials.	L3	PO1(3)	PSO1(2), PSO3(2)
CO3	Analyse the relationships between microstructure, composition, processing, and mechanical properties of metals, alloys, polymers, ceramics, and composites.	L4	PO2(3)	PSO1(2), PSO3(3)
CO4	Evaluate and recommend appropriate materials and heat treatment processes for engineering applications considering mechanical performance and industrial requirements.	L5	PO2(2), PO3(3)	PSO1(3), PSO2(1) PSO3(3)
CO5	Apply, analyse, and evaluate material behavior and engineering material selection through classroom activities such as problem solving, quizzes, model demonstrations, and case studies. (Only for CIE).	L3, L4, L5	PO5(3), PO8(2), PO9(3)	PSO3(3)

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25MES308	Embedded Systems and IoT	L	T	P	C
		2	0	0	2

Course Objectives:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

8-Bit embedded processor: Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

Activities: MCQ quiz on microcontroller architecture, identify processor blocks from diagram, simple puzzle on instruction set, demo of basic port programming. (Only for CIE).

Embedded c programming: Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

Activities: Write simple Embedded C program (LED blink), quiz on RTOS concepts, code debugging activity, flowchart of multitasking process. (Only for CIE).

IoT and arduino programming: Introduction to the Concept of iot Devices – iot Devices Versus Computers – iot Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

Activities: Identify Arduino board parts, simple Arduino coding activity, quiz on Arduino pins, demo of sensor interfacing with Arduino. (Only for CIE).

IoT communication and open platforms: IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

Activities: Quiz on IoT communication protocols, diagram labeling of IoT architecture, identify communication modules (WiFi/Bluetooth), demo of Raspberry Pi GPIO. (Only for CIE).

Applications development: Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare – Smart manufacturing.

Activities:. IoT applications, draw block diagram of smart home system, simple

puzzle on sensor–application matching, short presentation on IoT application.(Only for CIE).
Lecture: 30

Text Book:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 2014.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

Reference Book:

1 Michael J. Pont, “Embedded C”, Pearson Education, 2007.

2. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.

3.Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer's Guide”, Morgan Kauffman/ Elsevier, 2006.

4.Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.

E-Resources:

https://nptel.ac.in/courses/108105132
https://www.arduino.cc/en/Tutorial/HomePage
https://www.raspberrypi.org/documentation/
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
https://thingspeak.com

CO	Description of CO	Bloom’s Level	PO	PSO
CO1	Explain the architecture, programming concepts of embedded processors, interfacing techniques, IoT fundamentals, communication protocols, and applications of embedded and IoT systems.	L1, L2	-	-
CO2	Apply embedded C programming and IoT platform concepts to interface sensors, actuators, and communication modules using microcontrollers and open platforms.	L3	PO1(3)	PSO1(2)

CO3	Analyze embedded and IoT system operations including processor communication, scheduling, IoT protocols, and hardware–software integration for real-world applications.	L4	PO2(3)	PSO1 (2), PSO2 (2).
CO4	Evaluate and develop embedded and IoT based system designs using microcontrollers, Arduino/Raspberry Pi platforms, and communication networks.	L5	PO3(3)	PSO1 (2), PSO2 (2).
CO5	Apply, analyze and demonstrate embedded and IoT concepts through classroom activities such as quizzes, puzzles, coding exercises, demonstrations, and case discussions. (Only for CIE)	L3-L6	PO5(3), PO9(2), PO10(2).	PSO2 (2), PSO3 (1).

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25MPC309	**Computer Aided Machine Drawing**	L	T	P	C
		0	0	4	2

Course Objectives:

- To help the students to get knowledge on Limits, Fits, Tolerances, Geometric Dimensioning and Tolerance.
- To develop sectional views of fasteners, joints and couplings and various machine elements.
- To draw assembly of machine parts using Computer Aided Drawing software's.

PART I – CAD DRAWING STANDARDS, LIMITS, FITS & SYMBOLS

Application of drawing standards using CAD software. Practical exercises on:

1. BIS / ISO drawing practices in CAD
2. Limits, Fits and Tolerances
3. Basic hole basis and shaft basis systems
4. Dimensional tolerancing in CAD drawings
5. Geometric tolerancing (basic introduction)
6. Surface roughness symbols and indications
7. Welding symbols and weld representation in CAD
8. Standard machine elements representation
9. Preparation of production drawings using symbols and tolerances
10. Reading and interpretation of part drawings and assembly drawings

PART II – 2D MODELING AND DETAIL DRAFTING

Creation of 2D machine drawings using CAD commands:

Drawing tools, Modify tools. Dimensioning, Layers and line types, Hatching

Blocks, Array, Annotation, Plotting and printing

Practical Exercises:

1. Bearings – Bush Bearing
2. Valves – Safety Valve, Non-return Valve
3. Couplings – Flange, Oldham's, Muff, Gear Coupling
4. Joints – Universal Joint, Knuckle Joint, Gib & Cotter Joint, Sleeve & Cotter Joint
5. Engine Components – Piston, Connecting Rod, Crosshead, Stuffing Box, Multi-plate Clutch

6. Machine Components – Screw Jack, Machine Vice, Lathe Tailstock, Lathe Chuck, Plummer Block, Vane Pump, Gear Pump

PART III – 3D / SOLID MODELING AND ASSEMBLY

Creation of 3D part models and assemblies using CAD software.

Sketching for solid models, Extrude, Revolve, Sweep, Loft, Fillet, Chamfer, Shell, Draft, Pattern and Mirror features, Parametric modeling, Part editing and feature modification, Assembly constraints / mates, Exploded view creation, Section view generation, Orthographic drawing generation from 3D models, Rendering and visualization (basic)

Practical Exercises:

1. 3D Modeling of standard machine components
2. Assembly of Couplings and Joints
3. Pump Assembly Models
4. Vice / Screw Jack Assembly
5. Engine Part Models
6. Production Drawing from 3D Models

Practical: 60 hours

Reference:

1. N.D. Bhatt and V.M. Panchal Engineering Drawing (Plane and Solid Geometry) Charotar Publishing House, 54th Edition, 2023.
2. K.L. Narayana, P. Kannaiah and K. Venkata Reddy, Machine Drawing, New Age International Publishers, 4th Edition, 2020.
3. G.K. Narula and K.S. Narula, Machine Drawing, Dhanpat Rai Publications, 2021 Edition.
4. Cecil H. Jensen, Jay D. Helsel and Donald D. Voisinet, Engineering Drawing and Design, McGraw-Hill Education, 7th Edition, 2020.
5. K. Venugopal and V. Prabhu Raja, Engineering Drawing and Graphics using AutoCAD New Age International Publishers, 2019 Edition.
6. K.R. Gopalakrishna, Machine Drawing In First Angle Projection

E-Resources:

https://nptel.ac.in/courses/112102106

https://nptel.ac.in/courses/112105129

https://ocw.mit.edu

https://www.autodesk.com/learn

https://knowledge.autodesk.com

https://cadtutorials.org

https://www.gdandtbasics.com
https://www.engineeringtoolbox.com
https://grabcad.com/library
https://www.youtube.com/@nptelhrd

CO	Description of CO	Bloom's Level	POs	PSOs
CO1	Utilize engineering drawing standards and mechanical design principles including BIS specifications, limits, fits, tolerances and GD&T to produce graphical representations of machine elements such as bearings, valves, couplings, joints, engine parts and machine components.	L3	PO3 (2), PO5 (3), PO9 (1)	PSO1(2), PSO2 (1)
CO2	Investigate and interpret sectional and assembly drawings of fasteners, welded and riveted joints, bearings, valves, couplings and machine components to determine their configuration and functional relationships in mechanical systems.	L4, L5	PO3 (3), PO4 (2), PO5 (2), PO9 (1)	PSO1(3), PSO2 (2)
CO3	Design and document detailed and assembly drawings of mechanical components using manual drafting and CAD tools by organizing layers, dimensions, hatching and detailing for clear technical communication in engineering practice	L4, L5	PO3 (3), PO4 (2), PO5 (3), PO8 (1), PO9 (2)	PSO1(2), PSO2(3), PSO3 (1)

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Semester – IV

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Subject Code	25MBS401	Subject Title	TRANSFORMS AND NUMERICAL TECHNIQUES
Category	Basic science	L-P-T-C	3-0-1-4
Regulation	2025	Semester	IV
Prerequisites	Basic knowledge of calculus, differential equations, matrices, and elementary numerical methods		

Course Objectives:

1. To understand the concepts of Fourier series and Fourier transforms and apply them to represent periodic and non-periodic functions in mathematical and engineering problems.
2. To develop the ability to solve systems of linear equations numerically using methods such as Gaussian elimination, Gauss–Jordan method, and iterative techniques like Gauss-Jacobi and Gauss–Seidel methods.
3. To apply numerical methods for solving ordinary differential equations (ODEs) using techniques such as Euler's method, Taylor's method, Runge–Kutta methods, and multistep methods.
4. To analyze and implement numerical techniques for solving partial differential equations (PDEs) such as Laplace, Poisson, heat, and wave equations.
5. To understand convergence, stability, and accuracy of numerical methods used in solving mathematical problems arising in science and engineering.

Course Content:

[FOURIER SERIES] (9+3)

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range sine series – Half -range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

[FOURIER TRANSFORMS] (9+3)

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of elementary functions – Convolution theorem – Parseval's identity.

[LINEAR SYSTEM OF EQUATIONS AND EIGEN VALUE PROBLEMS] (9+3)

Solution of linear system – Gaussian elimination and Gauss-Jordan methods – Gauss-Jacobi and Gauss-Seidel iterative methods – sufficient conditions for convergence – Power method to find the dominant eigenvalue and eigenvector.

[NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS] (9+3)

Single step methods: Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order differential equations -Convergence and Stability analysis – Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

[NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS] (9+3)

Numerical solution of Laplace's equation and Poisson's equation by Liebmann's method – solution of one-dimensional heat flow equation – Bender–Schmidt recurrence relation – Crank–Nicolson method – solution of one-dimensional wave equation. **Total Hours:60**

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Recall the basic definitions, formulas, and concepts related to Fourier series, Fourier transforms, numerical methods for linear equations, and differential equations.	L1
CO2	Explain the principles of Dirichlet's conditions, Fourier series expansions, Fourier transforms, and numerical techniques used for solving mathematical problems.	L2
CO3	Apply numerical methods such as Gaussian elimination, Gauss-Jordan, Gauss-Jacobi, Gauss-Seidel for solving linear systems; Euler, Taylor's series, 4^{th} order Runge-Kutta, Milne's, and Adams' methods for solving ordinary differential equations.	L3
CO4	Analyze the convergence, stability, and accuracy of numerical methods used for solving linear systems and ordinary differential equations.	L4

CO5	Evaluate and develop numerical solutions for Laplace and Poisson equations using Liebmann's iteration, Heat equations using Bender–Schmidt and Crank–Nicolson methods, and Wave equations using explicit finite difference schemes.	L5

TEXT BOOKS :

1. Veerarajan, T., "Transforms and Partial Differential Equations", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2016.
2. Grewal, B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
3. Grewal, B. S., and Grewal, J. S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
4. Gerald, C. F., and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.
5. Burden, R. L., and Faires, J. D., "Numerical Analysis", 9th Edition, Cengage Learning, 2011.

REFERENCES :

1. Chapra, S. C., and Canale, R. P., "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
2. Bradie, Brian, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 2007.
3. Sankara Rao, K., "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2007.
4. Ramana, B. V., "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.
5. Kreyszig, Erwin, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.

E-resources:

1. https://nptel.ac.in/courses
2. https://nptel.ac.in/courses/111106111
3. https://nptel.ac.in/courses/111107105
4. https://swayam.gov.in

Course Articulation matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-

Correlation Levels:3- Strong,2- Medium,1 -Low, - (dash)-No correlation

Course Designed By

1. S. 12/2/26 (S. Goutham prakash) AP(T) / MAT
2. S. 12/3/26 (S. VADIVEL) AP(T) / Maths

12-03-26. (Dr. D. BABU) ASP

BOS Approval
Date: 12/3/2026

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Mechanical Engineering

(NBA Tier-I Accredited)

25MPC402	Kinematics of Machines	L	T	P	C
		3	0	0	3

Course Objectives:

- To make the students to understand the basics of mechanisms.
- To draw the velocity and acceleration diagram for simple mechanisms.
- To construct cam profile for given follower motion.
- To understand basics of gear and to develop gear trains for required application.
- To get knowledge to select appropriate type of friction drives for a specific application.

Basics of Mechanisms: Classification of mechanisms – basic kinematic concepts and definitions – degree of freedom, mobility – Kutzbach criterion, Grueblers criterion Grashofs Law kinematic inversions of four barchain and slider crank chains limit positions mechanical advantage transmission angle description of some common mechanisms quick return mechanisms- solving of simple problems.

Activities: Mechanism inversion Identification Quiz, Classify real-life mechanisms and calculate DOF, Four-Bar mechanism Model fabrication, Construct and verify Grashof's condition, ADAMS based simulation.(Only for CIE).

Kinematic Analysis: Displacement, velocity and acceleration analysis on simple mechanisms graphical and analytical techniques- instantaneous center of velocity Coriolis component Kleins construction for slider crank chain.

Activities: ADAMS based simulation & validation of velocity & Acceleration , Quiz& GATE exam questions solving. (Only for CIE).

Kinematics of cam mechanisms: Classification of cams and followers terminology and definitions displacement diagrams uniform velocity, parabolic, simple harmonic and cycloidal motions derivatives of follower motions layout of plate cam profiles specified contour cams circular arc and tangent cams pressure angle and undercutting sizing of cams.

Activities: Fabrication of CAM models, ADAMS based CAM simulation and validation, Quiz& GATE exam questions solving. (Only for CIE).

Gears and gear trains: Law of toothed gearing involutes and cycloidal tooth profiles spur gear terminology and definitionsgear tooth action contact ratio interference and undercut. Helical, bevel, worm. Gear trains Speed ratio, train value parallel axis gear trains epicyclic gear Trains.

Activities: Fabrication different Gears &Gear train models, verify speed Ratio, speed. ADAMS based simulation & Validation. (Only for CIE).

Friction drives : Belt and rope drive open and cross belt drive belt materials creep and slip - ratio of tensions effect of centrifugal force condition for maximum

power friction in journal bearing - flat pivot bearing - friction clutches single plate multi plate cone clutches-brakes - shoe brake and internal expanding brake only.

Activities: Fabrication of Rope/ Belt drive model, Slip & creep demonstration. Quiz& GATE exam questions solving (Only for CIE).

Lecture: 45

Text books:

1. Rattan S. S, Theory of Machines, Tata McGraw -Hill Publishers, New Delhi, 2014.
2. Thomas Bevan, Theory of Machines, Pearson Education Limited, 2010
3. John J Uicker, Gordan R Penncok& Joseph E Shigley,Theory of Machines and Mechanisms, Mcgraw Hill Inc,2010.

REFERENCES Books:

1. V.P.Singh, "Theory of Machines", Dhanapatrai and Sons, 2017.
2. George H.Maritn, Kinematics and Dynamics of Machines, Waveland PrInc, 2002.
3. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill, 2017.
4. C. E. Wilson, P. Sadler, Kinematics and Dynamics of Machinery, 3rd ed. , Pearson, 2014.

E-Resources:

https://nptel.ac.in/courses/112105268

https://mm-nitk.vlabs.ac.in

https://ocw.mit.edu/courses/mechanical-engineering/

https://simcompanion.mscsoftware.com

https://www.learnengineering.org

CO	Description of CO	Bloom's Level	POs	PSOs
CO1	Define and explain the fundamental concepts of mechanisms, kinematic analysis, cam mechanisms, gears, and friction drives, and identify their basic components and working principles.	L1, L2	–	–

CO2	Apply the principles of mechanisms, kinematic analysis, cam mechanisms, gears, and friction drives to solve basic engineering problems and determine performance parameters.	L3	PO1(3), PO2(1),	PSO1(2)
CO3	Analyze kinematic behavior of mechanisms, cams, gears, and friction drives to interpret motion and power transmission characteristics.	L4	PO2(3)	PSO1(3),PSO2(2)
CO4	Evaluate motion transmission and mechanical performance of mechanisms, gears, cams, and friction drives for informed design decisions.	L5	PO3(3)	PSO1(2), PSO2(3)
CO5	Design and develop mechanisms, cam systems, gear trains, and friction drive systems to create functional mechanical solutions for engineering applications. (Only for CIE).	L3-L 6	PO4(3), PO5(3), PO10(2), PO11(1)	PSO2(2), PSO3(3)

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

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Department of Mechanical Engineering

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25MPC403	Hydraulics and Pneumatics	L	T	P	C
		3	0	0	3

Course objectives:

- To provide the knowledge on the working principles of fluid power systems.
- To study the fluids and components used in modern industrial fluid power system.
- To develop the design, construction and operation of fluid power circuits.
- To learn the working principles of pneumatic power system and its components.
- To provide the knowledge of trouble shooting methods in fluid power systems.

Fluid power principles and hydraulic pumps: Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids -Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss –Work, Power and Torque- Problems, Sources of Hydraulic power: Pumping Theory-– Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problem.

Activities: Pascal's Law Demonstration using syringe hydraulic model, Pump identification quiz (gear, vane, piston). Quick numerical problems on work power and torque, Concept mapping activity of fluid power system components,Mini model making: simple hand-operated hydraulic press.(Only for CIE).

Hydraulic actuators and control components: Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Rotary Actuators-Hydraulic motors - Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Accessories: Reservoirs, Pressure Switches – Filters –types and selection- Applications – Fluid Power ANSI Symbols – Problems.

Activities: Component identification game using real valve models or images, Symbol drawing exercise (ANSI hydraulic symbols),MCQ quiz on valves and actuators, Problem solving: cylinder force and speed calculations.(Only for CIE).

Hydraulic circuits and systems: Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits, Sizing of hydraulic systems, Hydrostatic transmission, Electro hydraulic circuits, –Servo and Proportional valves – Applications- Mechanical, hydraulic servo systems.

Activities: Circuit identification quiz (regenerative, unloading, etc.), Group analysis: industrial hydraulic press circuit, Simulation comparison of regenerative vs. conventional circuits, Troubleshooting puzzle: identify faulty component in a circuit, Numerical problems on hydrostatic transmission.(Only for CIE).

Pneumatic and electro pneumatic systems: Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust

Valves, Pneumatic actuators, Design of Pneumatic circuit –classification- single cylinder and multi cylinder circuits-Cascade method –Integration of fringe circuits, Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems, Introduction to fluidics and pneumatic logic circuits.

Activities: Air preparation unit identification activity, symbol drawing test for pneumatic components, Cascade method puzzle for multi-cylinder sequence, Ladder diagram development exercise, Group activity: design a pneumatic circuit for clamping. . (Only for CIE).

Trouble shooting and applications: Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications – Air Compressors - mobile hydraulics; Design of Pneumatic circuits for metal working, handling, clamping counter and timer circuits. – Low-cost Automation – Hydraulic and Pneumatic power packs, IOT in Hydraulics and pneumatics.

Activities: Fault diagnosis quiz for hydraulic systems, Case study discussion: hydraulic press maintenance, Circuit design challenge for drilling machine, Matching activity: faults with remedies, IoT in hydraulics brainstorming session. (Only for CIE).

Lecture: 45

Text books:

1. Anthony esposito, “fluid power with applications”, prentice hall, 2009.
2. James a. Sullivan, “fluid power theory and applications”, fourth edition, prentice hall, 1997

References books:

1. Jagadeesha. T., “pneumatics concepts, design and applications “, universities Press, 2015.

2. Joshi.p., pneumatic control”, wiley india, 2008.

3. Majumdar, s.r., “oil hydraulics systems – principles and maintenance”,tatamcgraw hill, 2001.

4. Shanmugasundaram.k., “hydraulic and pneumatic controls”. Chand & co, 2006.

5.Srinivasan.r., hydraulic and pneumatic controls”, vijay nicole imprints, 3rd edition,2019.

E-resources:

https://archive.nptel.ac.in/courses/112/106/112106300/?utm_source=chatgpt.com

https://docslib.org/doc/1908894/lecture-1-introduction-to-hydraulics-and-pneumatics

https://about.openlibhums.org/Download_PDFS/papersCollection/X6Js5t/HydraulicsAndPneumaticsTextbook.pdf

	Course Outcome	Bloom's Level	POs	PSOs
CO1	Explain the fundamental principles of fluid power systems including hydraulic fluids, Pascal's law, flow principles, pumps, hydraulic and pneumatic components and their functions.	L1, L2	-	-
CO2	Apply the principles of hydraulics and pneumatics to solve engineering problems related to pump performance, cylinder force, speed, power and basic circuit calculations	L3	PO1(2), PO2(1)	PSO1(2), PSO2(1)
CO3	Analyze the operation and performance of hydraulic and pneumatic circuits such as regenerative, unloading, sequencing, cascade and electro-pneumatic systems for industrial applications	L4	PO2(2), PO3(3), PO4(1)	PSO1(2), PSO2(3), PSO3(1)
CO4	Design and evaluate hydraulic and pneumatic circuits for machine tool and automation applications considering system components, efficiency, maintenance and troubleshooting aspects.	L5	PO2(3), PO3(2), PO4(2)	PSO1(3), PSO2(3)
CO5	Analyze, simulate and demonstrate hydraulic and pneumatic components and circuits through problem solving, circuit design, troubleshooting exercises and mini-projects for real industrial applications.(Only for CIE).	L6	PO5(3), PO8(1), PO9(2), PO10(2), PO11(2)	PSO1(3), PSO2(3), PSO3(2)

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

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Department of Mechanical Engineering

(NBA Tier-I Accredited)

25MPC404	Thermal Engineering	L	T	P	C
		3	0	2	4

Course objectives:

1. To enable the students, understand the principles, working and performance of IC engines
2. To introduce students to the working of compressors, steam nozzles and various refrigeration and air-conditioning systems.
3. To teach students the principles of waste heat recovery and thermal storage systems.

INTERNAL COMBUSTION ENGINES

Classification of IC engines – Working of SI & CI, two and four stroke engines – Ideal and actual valve and port timing diagrams – Comparison of ideal and actual air standard cycles (p-v diagram) – Engine operating characteristics: mean effective pressure, torque and power, specific fuel consumption, efficiencies, pressure-crank angle diagram.

Activities:

Demonstrate the working of two-stroke and four-stroke SI/CI engines using cut-section models or simulation software and conduct performance tests to plot engine characteristics such as brake power, fuel consumption and efficiency curves.

BOILERS, STEAM AND GAS TURBINE CYCLES

Subcritical and supercritical boilers, fluidized bed boilers, fire-tube and water-tube boilers, mountings and accessories - Steam turbine basic cycles – velocity diagrams, Work done and efficiency –Application of Mollier diagram, Gas turbine basic cycle (open and closed), Application of intercooling, reheating and regeneration – cogeneration and combined system.

Activities:

Prepare a comparative study of different boilers with industrial applications and perform steam and gas turbine cycle analysis using Mollier charts or simulation tools for efficiency improvement.

STEAM NOZZLES

Types and Shapes of nozzles – Flow through nozzles – Stagnation, sonic properties and isentropic expansion in nozzle – Critical pressure ratio – Effect of friction. Metastable flow.

Activities:

Demonstrate convergent and convergent-divergent nozzle flow behavior through experiments or CFD simulation and evaluate nozzle efficiency, critical pressure ratio and flow parameters under varying conditions.

AIR COMPRESSORS

Classification of compressors – Radial and axial compressors – Performance characteristics: Volumetric efficiency, Isothermal efficiency and Isentropic efficiency

– Effect of clearance volume – Multi stage air compressor with intercooling – Surging and stalling.

Activities:

Conduct experiments on compressors to determine volumetric and isentropic efficiencies and develop mini models or presentations illustrating multistage compression, intercooling, surging and stalling phenomena.

REFRIGERATION & AIR CONDITIONING SYSTEM

Vapour compression system – Effect of Super heat and Sub cooling – Performance calculations - Vapour absorption system - Ammonia water, Lithium bromide water – Psychrometric processes – Air conditioning system – Working principles and concept of RSHF, GSHF, ESHF- Cooling load calculations.

Activities:

Perform refrigeration cycle performance calculations to study the effects of superheating and subcooling and carry out psychrometric analysis with cooling load estimation for air-conditioning applications.

Practical: (Any 8)

1. Valve timing and port timing diagrams
2. Heat balance test on 4-stroke water cooled / Air cooled Engine.
3. Morse test on Multi-cylinder four stroke SI Engine.
4. Performance test on Multi-cylinder four stroke Engine.
5. Performance test on single cylinder two stroke Engine
6. Study and performance test on a reciprocating Air Compressor
7. Determination of viscosity using Redwood viscometer.
8. Determination of flash point and fire point of various fuels / lubricants.
9. Retardation test to find frictional power of a diesel engine.
10. Performance and energy balance test on steam turbine.
11. Determination of COP of a vapour compression refrigeration system.

LECTURE: 45 Practical: 30 TOTALS :75 Hours

Text books:

1. Rajput R.K. “Thermal Engineering” Laxmi Publications (P) Ltd., 2017.
2. DomkundwarandKothandaraman C.P.“Thermal Engineering” Khanna Publishers,
3. New Delhi, 2010.
4. Mahesh M Rathore, “Thermal Engineering”TataMcGraw Hill, New Delhi, 2010.

References books:

1. Rudramoorthy R. “Thermal Engineering”Tata McGraw-Hill, New Delhi,2017.
2. Sarkar B. K.“Thermal Engineering” Tata McGraw-Hill, New Delhi, 2017.
3. Ganesan V.“Internal Combustion Engines” Tata McGraw-Hill, New Delhi, 2017.
4. Arora C.P. “Refrigeration and Air Conditioning”Tata McGraw-Hill Publishers, 2017.

E-resources:
https://nptel.ac.in/courses/112105266
https://nptel.ac.in/courses/112104113
https://vlab.co.in/https://vlab.co.in)
https://www.thermopedia.com
https://www.engineeringtoolbox.com

	Course Outcome	Bloom's Level	POs	PSOs
CO1	Explain the principles, construction, working cycles and performance characteristics of IC engines, boilers, steam nozzles, compressors, refrigeration and air-conditioning systems	L1, L2	-	-
CO2	Apply thermodynamic principles to analyze the performance of IC engines, steam and gas turbine cycles, compressors, steam nozzles and refrigeration systems using standard relations and performance parameters.	L3	PO1	PSO1
CO3	Analyze and evaluate the performance of thermal systems such as boilers, compressors, gas turbines and refrigeration systems under varying operating conditions to improve efficiency and energy utilization.	L4, L5	PO2	PSO1
CO4	Design or develop suitable thermal system models, waste heat recovery arrangements, thermal storage concepts, or energy-efficient refrigeration and air-conditioning solutions for practical engineering applications.	L6	PO3, PO5, PO7	PSO2
CO5	Demonstrate the working and performance characteristics of IC engines, compressors, refrigeration and air-conditioning systems through experiments, simulations, mini projects, working models and group activities with professional and team-oriented practices.	L3,L4	PO4, PO5, PO9, PO10, PO12	PSO3

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

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Department of Mechanical Engineering

(NBA Tier-I Accredited)

Course code	25ZBS406	Course Title	Environmental Sciences and Sustainability
Category	Basic Science	L-P-T-C	2-0-0-2
Regulation	R-2025	Semester	04
Prerequisites	Nil		

Course Objectives:

1. To define key terms, concepts, and principles of environmental science, ecology, biodiversity, pollution, environmental laws and sustainability.
2. To understand the inter relationship between environment and living organisms.Environmental literacy about where do the things I consume come from;what do I know about the place where I live and my responsibility as a human being in environmental conservation.
3. To equip students to apply environmental principles and scientific methods to solve real-world environmental problems.
4. To enable the students to analysecomplex environmental issues, their root causes and connections between environmental, social, and economic systems.
5. To evaluate the waste management strategies, energy efficiency, carbon footprints and standards regarding environmental policies and sustainable practices.

ENVIRONMENT AND BIODIVERSITY — 6 hours

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

ENVIRONMENTAL POLLUTION — 6 hours

Pollution: Definition - Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Hazardous waste: definition – types - Solid waste - Solid waste management - waste disposal methods – E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

RENEWABLE SOURCES OF ENERGY — 6 hours

Renewable and non-renewable energy resources - Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

SUSTAINABILITY AND MANAGEMENT — 6 hours

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

SUSTAINABILITY PRACTICES — 6 hours

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socioeconomical and technological change.

TOTAL: 30 PERIODS

Upon successful completion of this course, student will be able to,		
CO	**Course Outcome**	**Bloom's Level**
CO1	Environmentalproblems cannot be solved by mere laws. Public awareness is an important aspect which defines the importance of environment conservation and its benefits.	L1
CO2	The key goals of environmental literacy will help the students, to make a leap from – Yes I KNOW about my environment, I will CARE for my environment and I will RESPECT and conserve my environment.	L2
CO3	Apply environmental laws and regulations to specific case studies.Implement new technologies in solving environmental problems can move towards health, longevity, peace and prosperity.	L3
CO4	Analysing the values and attitudes towards understanding complex environmental-economic-social challenges, and participating actively in solving current environmental problems by adopting sustainability as a practice in life, society and industry.	L4
CO5	Evaluate and designan eco-friendly product or a green technology solution for improving environmental quality and develop a better understanding of human relationships, perceptions and policies towards the environment.	L5

Text Books:

1. G. Tyler Miller & Scott Spoolman, "Environmental Science" 16th edition, Cengage Learning India Pvt. Ltd., 2023.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

Reference Books:

1. R K Trivedy, "Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards" Vol.I, B.S. Publications, 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopaedia", 2nd Edition, Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India Pvt. Ltd., New Delhi,2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.
5. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.

COURSE ARTICULATION MATRIX											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1											
CO2	2	2	2		2	2	2	1	1		2
CO3	2	2	2		2	2	2	1	1		2
CO4	2	2	2		2	2	2	1	1		2
CO5	2	2	2		2	2	2	1	1		2

Correlation Levels: 3 – Strong, 2 – Medium, 1 – Low and (-) No correlation

Course Designed by

1. **Dr.G.SARASWATHY, ASP & Head/Chemistry.**
2. **Dr.S.ELUMALAI, AP/Chemistry.**

BoS Approval
Date: 12.03.2026.

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

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Department of Mechanical Engineering

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25MPC405	Fluid Mechanics and Hydraulic Machines	L	T	P	C
		3	0	2	4

Course Objectives:

- To familiarize with the properties of fluids and the applications of fluid mechanic and fluid machines.
- To classify flows and to understand and apply the conservation principles for fluid flows
- To develop advanced knowledge of viscous flow in conduits, boundary layer behavior, pipe flow losses, and the application of dimensional analysis and similarity principles for fluid system analysis and modeling.
- To understand the working principles, performance characteristics, and efficiency analysis of hydraulic pumps and reciprocating systems in fluid engineering applications.
- To critically analyze the classification, design, performance characteristics, and governing strategies of hydraulic turbines for efficient hydroelectric power generation.

Fluid properties: Units and dimensions – fluid properties – density, specific gravity, viscosity, surface tension, capillarity, compressibility and bulk modulus – Pascal's Law – pressure measurements – manometers - Fluid statics - Total pressure and centre of pressure on submerged surfaces.

Activities: MCQ quiz on fluid properties and pressure measurement, diagram labeling of manometers, solving GATE problems on hydrostatic pressure and centre of pressure. Flowchart for pressure measurement methods, concept puzzles on Pascal's law. (Only for CIE)

Fluid kinematics and dynamics: Types of fluid flow and flow lines – control volume – continuity equation in one-dimension and three dimension – velocity potential and stream function -energy equation – Euler and Bernoulli's equations – applications of energy equations- flow meters.

Activities: Draw and label streamlines/pathlines/streaklines, MCQ quiz on continuity equation & fluid flow, solving GATE problems on Bernoulli's equation and energy equation. Demo model of venturimeter and rotameter.(Only for CIE)

Flow through pipes and dimensional analysis: Laminar flow through circular conduits, orifice, venture, Rota meter (simple problems) and circular annuli- boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – flow through pipes in series and parallel- hydraulic and energy gradient – methods of dimensional analysis – dimensionless parameters- application of dimensionless parameters – model analysis- Buckingham π theorem.

Activities: Diagram labeling of boundary layer regions, MCQ quiz on Darcy–Weisbach equation, solving GATE problems on pipe friction losses, Moody

diagram interpretation activity. Demo model for pipe head losses, flowchart for Buckingham π theorem steps, and concept puzzle on Reynolds number. (Only for CIE)

Pumps: working principle – discharge, work done and efficiencies – gear, centrifugal and reciprocating pumps- work done and efficiencies – negative slip – flow separation conditions – air vessels – indicator diagram and its variation – savings in work done.

Activities: Identify pump types from images, diagram labeling of centrifugal pump components, MCQ quiz on pump efficiencies, solving GATE problems on pump discharge and work done. Demo model of centrifugal pump & reciprocating pump cycle. (Only for CIE)

Hydraulic turbine: Classification – construction, working principles and design of Pelton wheel, Francis and Kaplan turbines – head, losses, work done and efficiency – specific speed – operating characteristics – governing of turbines.

Activities: Identify Pelton, Francis and Kaplan turbines from diagrams, labeling of turbine components, MCQ quiz on turbine classification, solving GATE problems on turbineefficiency. Demo model of Pelton wheel, concept puzzle on turbine governing, simulation of turbine operation. (Only for CIE)

Practical:

1. Determination of coefficient of discharge of a venturimeter.
2. Determination of forces due to impact of jet on a fixed plate.
3. Determination of friction factor for flow through pipes.
4. Characteristics of centrifugal pumps.
5. Characteristics of reciprocating pump.
6. Characteristics of Pelton wheel turbine.
7. Orifice meter
8. Gear oil pump

Lecture: 45, Practical: 30, Total: 75 hours

Text Book:

1. Rajput R. K., “A text Book of Fluid Mechanics and Machinery”, S. Chand and Company, New Delhi, 2015.

2. RamamruthamS.“Hydraulics, Fluid Mechanics and Fluid Machines”, Dhanpat Rai Publishing House (P) Ltd, New Delhi, 2012.

3. Modi P. N. and Seth S. M., “Hydraulics and Fluid Mechanics including Hydraulic. Machines”, Standard book house, Delhi, 2004.

4. R.K Bansal “A Textbook of Fluid Mechanics and Hydraulic Machines”,Laxmi

Publications p) Ltd.,2017.

Reference Book:

1. Streeter V.L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2017.

2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi,2010.

3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”, 2011.

4. Graebel W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.

E-Resources:

https://nptel.ac.in/courses/112105269

https://nptel.ac.in/courses/112104118

https://nptel.ac.in/courses/105101082

https://fm-nitk.vlabs.ac.in

https://fm-nitk.vlabs.ac.in/exp/venturimeter

https://vlab.amrita.edu

https://me.iitp.ac.in/Virtual-Fluid-Laboratory

https://eerc03-iiith.vlabs.ac.in/exp/venturi-meter

https://virtual-labs.github.io/exp-flow-through-venturi-meter-nitk

https://www.youtube.com/watch?v=F_7OhKUYV5c

CO	Description of CO	Bloom’s Level	PO	PSO
CO1	Explain the basic concepts of fluid mechanics including fluid properties, pressure measurement, hydrostatics, fluid kinematics and dynamics, pipe flow behaviour, and the fundamental components of pumps and hydraulic turbines used in engineering applications	L1, L2	-	-
CO2	Apply fundamental fluid flow principles through continuity equation, Bernoulli’s equation and energy equations, along with dimensional analysis, to solve engineering problems related to fluid	L3	PO1 (3)	PSO1 (2)

	flow and hydraulic machines			

CO3	Examine and interpret fluid flow behaviour in pipes and boundary layers by analysing friction losses, hydraulic gradients, dimensional similarity and the operational characteristics of pumps and turbines	L4	PO2 (3), PO3 (2)	PSO1(2), PSO2 (1)
CO4	Design, develop and evaluate fluid flow systems and hydraulic machines by determining pump and turbine performance, efficiencies and operating characteristics for effective fluid transport and hydro-power applications.	L4,L5	PO2 (2), PO3 (2), PO4 (3)	PSO1(1), PSO2 (2) PSO3 (2)
CO5	Apply, analyze and evaluate fluid mechanics concepts through activity-based learning such as quizzes, diagram identification, solving GATE problems, flowchart preparation, demonstration models and simulations related to fluid properties, fluid flow behaviour, pipe flow analysis, pumps and hydraulic turbines. (Only for CIE)	L3, L4, L5	PO5 (3), PO9 (2), PO10 (2), PO11 (2)	PSO1(2), PSO2 (2), PSO3 (2)

25MPC407	Manufacturing Technology	L	T	P	C
		3	0	2	4

Course objectives:

- To study the concepts and basic mechanics of metal cutting and the factors affecting machinability
- To learn working of basic and advanced turning machines.
- To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes.
- To study the basic concepts of CNC of machine tools and constructional features of CNC.
- To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre

Mechanics of metal cutting: Mechanics of chip formation, forces in machining, Types of chip, cutting tools – single point cutting tool nomenclature, orthogonal and oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

Activities: Chip type identification quiz, MCQs on tool wear mechanisms, Solving competitive examination problem on Merchant's circle diagram, Flowchart creation for chip formation process, Problem solving on tool life equation.(Only for CIE).

Turning machines: Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, surface roughness in turning, machining time and power estimation. Special lathes - Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

Activities: Draw and label centre lathe parts, Match taper turning method with application, Tool layout activity for capstan/turret lathe, Case study discussion on turning process optimization.(Only for CIE).

Special machine tools: Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutters– machining time calculation - Gear cutting, gear hobbing and gear shaping – gear finishing methods Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods

Activities: Identify milling cutter types from images, Short discussion on centreless grinding, Grinding wheel specification decoding quiz, Solving competitive examination problem on machining processes. (Only for CIE).

CNC machines: Computer Numerical Control (CNC) machine tools, constructional details, special features – Drives, Recirculating ball screws, tool changers; CNC Control systems – Open/closed, point-to-point/continuous - Turning and machining

centres – Work holding methods in Turning and machining centres, Coolant systems, Safety features.

Activities: Quiz on CNC system classification, Ball screw working principle demonstration, Diagram labeling of CNC turning centre, Group discussion on advantages of CNC over conventional machines. (Only for CIE).

Programming of cnc machine tools: Coordinates, axis and motion, Absolute vs Incremental, Interpolators, Polar coordinates, Program planning, G and M codes, Manual part programming for CNC machining centers and Turning centers – Fixed cycles, Loops and subroutines, Setting up a CNC machine for machining.

Activities: Write simple G & M code program (square profile), Quiz on Absolute vs Incremental coordinate, Debugging activity (find error in CNC program), MCQs on CNC codes, Simulation video analysis of CNC program execution. (Only for CIE).

LIST OF EXPERIMENTS

Part A

1. Facing, plain, step and taper turning.
2. Knurling and chamfering and thread cutting (external).
3. Counter sinking ,drilling and boring
4. Contour milling using vertical milling machine.
5. Spur gear cutting in milling machine.
6. Gear generation in Hobbing machine.
7. Plain Surface grinding.

Part B

1. CNC Machining Centre i) Linear Cutting. ii) Circular cutting. iii) Cutter Radius Compensation. iv) Canned Cycle Operations.
2. CNC Turning Centre i) Straight, Taper and Radial Turning. ii) Thread Cutting. iii) Rough and Finish Turning Cycle. iv) Drilling and Tapping Cycle.

Lecture: 45, Practical: 30, Total: 75 hours

Text books:

1.Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India,7th Edition, 2018.
2.Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 4th edition, 2018.

References books:

1.Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.
2.Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 1984.
3.Rao. P.N “Manufacturing Technology,” Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2009.
4.A. B. Chattopadhyay, Machining and Machine Tools, Wiley, 2nd edition, 2017.
5.Peter Smid, CNC Programming Handbook, Industrial Press Inc.;Third edition, 2007.

E-resources:

https://nptel.ac.in/courses/112107083
https://www.sandvik.coromant.com/en/knowledge
https://ncviewer.com
https://ocw.mit.edu/courses/mechanical-engineering/
https://www.engineeringtoolbox.com/machining-tools-d_1642.html

	Course Outcome	Bloom's Level	POs	PSOs
CO1	Explain the fundamentals of metal cutting, construction and operations of machine tools, CNC systems, and CNC programming concepts used in machining processes.	L1, L2	-	-
CO2	Apply engineering principles to determine machining parameters, select appropriate cutting tools, and perform machining operations on conventional and CNC machine tools.	L3	PO1(3)	PSO1(2), PSO2(3)
CO3	Analyse machining processes, cutting tool performance, machining parameters, and CNC machining operations to improve productivity and surface quality.	L4	PO1(2), PO2(3)	PSO1(2), PSO2(2)
CO4	Evaluate machining methods and develop CNC programs for machining components considering accuracy, efficiency, and industrial requirements.	L5	PO2(2), PO3(3)	PSO1(3), PSO2(3)
CO5	Apply, analyse, and evaluate machining principles and CNC programming concepts through classroom activities such as problem solving, quizzes, program writing, demonstrations, and case discussions.(Only for CIE).	L3, L4, L5	PO5(3), PO8(2), PO9(3)	PSO2(3)